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**URBAN WARFARE AT THE OPERATIONAL LEVEL:
IDENTIFYING CENTERS OF GRAVITY AND KEY NODES**

by

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14. ABSTRACT

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Preface

One might ask why an Air Force officer takes interest in the subject of urban operations. My interest was piqued when I was an intelligence operations officer with a joint special operations unit at Ft Bragg. During my tenure, I had supporting roles in planning and conducting operations in Mogadishu, Port-au-Prince, and Sarajevo (as well as several urban exercises). I realized that intelligence support for these operations was quite different from “normal” operations. I also saw mistakes, many of which were my own, that resulted from a lack of appreciation for these subtle differences.

I originally intended to right about the experiences of Task Force RANGER in Somalia. As I conducted my research, I realized the problem of urban warfare was larger than one operation. I also saw that the current work on urban warfare emphasizes tactical aspects. Air Command and Staff College focuses the student on operational level issues. This is why I decided to write about operational level issues in urban warfare. As an intelligence officer, I elected to use center of gravity/nodal analysis as the vehicle.

I would like to acknowledge the assistance of the staff at the Fairchild Library at Air University for assisting me in my research. I am also grateful for the guidance of my Faculty Research Advisor, LTC Jeffrey Reilly, whose experience and assistance helped me maintain my focus.

Abstract

The unprecedented rate of growth of the world population, combined with the migration to cities in the developing world, portend an increase in military operations in the urban environment. The intent of this paper is to focus the reader on the operational level of urban warfare. A key task for the Joint Force Commander and his staff will be to identify the targets against which he will employ his component forces. One method of doing this is by using John Warden's Five Ring Analysis as an aid in identifying key centers of gravity (COGs), then to perform a nodal analysis on those COGs in order to determine the specific components to be attacked.

In order to demonstrate this technique in urban operations, three typical mission types will be examined: noncombatant evacuation operations (NEOs), apprehension of individuals, and attacking nuclear weapons production capabilities. Why these three? First, they all have significant impact on national interests. NEOs, which occur more often than any other urban operation, involve the protection of US civilians from death or injury. Apprehension missions, especially if the individual is a terrorist leader, directly target those who initiate attacks on US citizens or in other ways threaten national interests. Finally, nuclear proliferation presents the gravest danger to the US. The best way to defend against nuclear attack by a rogue state is to eliminate the production capability before the weapons exist.

The second reason for selecting these three mission types is variety. Each presents a different operational environment. NEOs require restraint and avoidance of combat and may take place in hostile, permissive, or semipermissive environments. Apprehension missions involve locating one individual in territory he is familiar with, and within which he enjoys informational superiority. Once he is located, the JFC's forces must surgically apply force in a manner which brings the individual into custody with minimum injury to anyone involved. Attacking nuclear facilities requires more firepower and less concern for collateral damage. These facilities are usually the most heavily defended targets in a country and involve the most risk to American forces.

While these three missions are all key to US interests, they are only a few among the many missions one could envision in urban terrain. However, examining these three introduces the reader to the methods involved in target development at the operational level in the urban environment.

The individual nodes and sample missions are not the important product. The purpose of the paper is to show the process, and to move military planners from tactical level analysis of urban operations to the operational level.

Chapter 1

Introduction

Urban operations are not new in warfare. Sun Tzu, writing in China some five centuries before Christ¹, already noted the complexities of urban warfare. He clearly stated that attacking cities was to be avoided, and should be attempted only "...when there is no alternative."² The technological innovations of the present century have resulted in a whole new concept, "total war," in which cities and civilians have become targets. Stalingrad, Berlin, Panama City, and Mogadishu all bear witness to the urbanization of warfare. Although these are recent battles, certain trends will make urban operations unrecognizable to those who fought in these campaigns. For example, social trends such as population growth and urbanization will make urban operations more frequent. Additionally, conduct of these operations will be affected in the next century by certain revolutions in military affairs (RMAs), such as precision guided munitions, information warfare, and space technology. Finally, new ideas such as non-lethal weapons will also affect the options available to Joint Task Force (JTF) commanders operating in an urban environment.

The services have responded to this trend by developing new doctrine as well as tactics, techniques, and procedures (TTP) for the evolving nature of urban warfare. However, virtually all of their effort has been focused on the tactical level.³ The purpose

of this paper is to examine urban combat at the operational level of warfare. Specifically, missions will be examined from the point of view of the Joint Force Commander (JFC). To aid in course of action development, the paper will identify centers of gravity for three potential urban operations: the noncombatant evacuation operation (NEO), apprehension of a key individual, and disruption of a nuclear weapons program. After identifying the centers of gravity, the paper will determine which are key nodes. These, in turn, will be examined through nodal analysis, leading to the determination of key targets for future JFCs.

Significance of the Problem

The problem of conducting urban operations is significant as we move toward the future. The Chairman of the Joint Chiefs of Staff, General Hugh Shelton, identified urban warfare as a key asymmetric threat in the most recent Joint Strategy Review.⁴ The Joint Strategic Capabilities Plan gives guidance for planning urban warfare.⁵ Finally, the Chairman's Program Recommendation for FY00 includes urban warfare in the model of future capabilities we must attain.⁶ Why such high-level interest? After all, we have had an urban warfare capability for decades. The difference is that warfare is moving out of the open spaces and into the streets. At the same time, the drawdown of the US military and its evolution to an expeditionary, rather than forward-deployed, force, make it impossible for us to control an entire city in order to meet our objectives. Further, such warfare will be technologically sophisticated and will rely on precision and information rather than brute force. We will be fighting on someone else's home turf, so we must use

our technological and doctrinal advantages to prevent the kind of failure that occurred on 3 Oct 1993 in Mogadishu, Somalia.

Scope

A complete treatment of the issue of urban warfare would be book-length and cover all military activity that takes place in an urban environment. There are scores of qualitatively diverse missions that could confront a JFC. Therefore, the paper will be limited to those mission types specified above. They were chosen because of their likelihood or gravity, as well as the breadth of challenges they present. This paper will focus on the operational level of war, since tactical considerations have been sufficiently addressed by the services.

Structure

Chapter Two will set the stage by showing that population trends mitigate toward an increase in urban warfare. Not only is the world population growing at an unprecedented rate, but that population is shifting to the cities. This shift will set in motion forces which lead to conflict – conflict which undoubtedly will threaten US national interests.

The third chapter will examine the specific military aspects of this trend. Why are urban areas important in war? What makes combat more difficult in a city?

Chapter Four will show that present-day thinking on urban operations is focused on the tactical level. There is a void in operational thought. Operational level urban warfare will be introduced, along with a method of examining the mission at this level: the Five Ring Analysis.

Chapters Five, Six, and Seven will go into detail on operational level analysis for urban warfare. Each chapter corresponds to a mission type, and will include a five ring analysis, identification of key nodes, and nodal analysis. Each chapter will conclude with a recommendation of target sets for the JFC.

Finally, Chapter Eight will briefly summarize the conclusions of the preceding analysis. This will serve as a jumping off point for future research or critique.

Hopefully, this paper will help the JFC and his planning staff to develop effective courses of action which accomplish the operational level objectives with the dwindling resources available.

Notes

¹ Sun Tzu, The Art of War. (London: Oxford University Press, 1963) pp 1-7. There is considerable doubt as to the actual time period in which Sun Tzu lived, as well as to whether there actually was a “Sun Tzu” or if he is an amalgamation of ancient scholars. However, the passage on pages 1-7 indicates that most scholars believe The Art of War was written in the Fifth Century B.C.

² Sun Tzu, 78.

³ See Chapter Four for a detailed examination of current service initiatives.

⁴ Lt Col Tim Vining, USAF, “The Joint Strategic Planning System.” Lecture given at the Air Command and Staff College, Maxwell AFB. AL, 25 Jan 1999.

⁵ Ibid.

⁶ Ibid

Chapter Two

The Urbanization of the World

In my forty-six years, we have gone from a little over two billion to almost six billion people. And, if I'm fortunate enough to live another forty-six years, I will watch the world's population almost certainly rise to nearly nine billion.

- Vice President Al Gore
“Overpopulation Threatens the Earth’s Future”¹

Vice President Gore points out in dramatic fashion where we are headed as a planet. As a civilization, we have been quite successful. We have cured diseases, raised standards of living, and eliminated many of the obstacles to long and fruitful life. However, as the Vice President points out, this success has resulted in an explosion of population that may have Malthusian results.

Gore and his co-author, Paul Kennedy, point out the implications of such accelerated growth. For example, poverty and economic disparity will increase.² As the World Resources Institute puts it, “the current pace and scale of change...often strain the capacity of local and national governments to provide even the most basic services to urban residents.”³ Military officers know that these conditions cause men and women to take up arms against one another. Gore and Kennedy also state that the population explosion will lead to a degradation of natural resources.⁴ Our National Security Strategy cites such a trend as a threat to peace: “Natural resource scarcities can trigger and exacerbate conflict.”⁵

Much of this increase will occur in areas of instability, the fertile ground for future conflict. Ninety-five percent of the increase will occur in India, China, Central America, and Africa.⁶ The most rapid increase will occur in troubled Afghanistan, where the population *will double by 2004.*⁷

The problem is not just the total number of people, but where they will live. As the population grows, it will continue its migration into the cities. According to the Marine Corps Intelligence Agency, the majority of people will live in cities by 2005.⁸ As the number of people outstrips urban resources, the result can be "...an infrastructure inadequate to absorb new city residents, an insufficient economic base to keep pace with the rising population, and a lack of adequate resources and services to accommodate urban growth."⁹ This will leave a large, unhappy population in a small space, leading to conflict among classes and ethnic groups that would coexist peacefully in other conditions.¹⁰

Another disturbing trend is the aging of the urban population. According to a press release by the United Nations Population Information Network, the number of persons over the age of eighty will increase six-fold by 2050.¹¹ These elderly residents will not contribute to the economic base of the city, but will still require housing, food, and medical care.

As Gore and Kennedy point out, the growth is disproportionately high in the countries that are least prepared and that have already seen a great deal of conflict.¹² For the period 1930-2020 (projected at current rates), the developing world will account for 90% of global population growth.¹³ Compare the total growth of urban populations between 1970 and 1993: 208 million in developed countries, versus 910 million in

developing states.¹⁴ By 2020, developing countries will add another 1.6 billion to their rolls, at current rates.¹⁵ Because of this explosion in developing urban areas, most of the world's largest cities are in the Third World. Of the thirty most populous urban areas, 21 are in the developing world.¹⁶ A glance at the largest cities, as projected for ten years hence, reads like a Who's Who of global instability (Table 1):

City	Projected Population, 2010 (millions)
Tokyo	28.7
Bombay	24.3
Shanghai	21.5
Lagos	20.8
Sao Paolo	20.1
Jakarta	19.2
Mexico City	18.2
Beijing	17.8
Karachi	17.6
New York	17.3
Dhaka	16.0
Calcutta	15.6
Tiajin	15.6
Delhi	15.5
Los Angeles	14.0

Table 1 Fifteen Largest Cities by Population, 2010 (Projected)¹⁷

This urbanization, however, will not be restricted to large cities. In some cases, medium-sized cities will grow at a rate three times that of the largest.¹⁸ In countries with limited resources, the medium-sized cities probably will be allocated less than the major urban centers, making their lot even worse.

Consider these other statistics and the implications they can have for US national interests and the conduct of warfare in the next century:

- The number of people living in cities tripled from 1950 to 1993.¹⁹
- Every year in the developing world, the number of city dwellers increases by four times the population of New York City.²⁰
- By the end of next year, the population of Mexico City will be eight times its 1950 population; Sao Paolo's will be ten times its 1950 total.²¹
- According to the United Nations Population Fund, the number of so-called “megacities” (over 10 million inhabitants) will double to 28 by 2015. The UN sees these cities as the largest threat to stability, since they have the worst chance of meeting the physical needs of the people.²²

The message is clear: a population explosion, combined with urban migration, is underway and accelerating. The result will be more conflict as people crowd into cities with limited resources, and that conflict will be played out in an urban environment.

Notes

¹ Al Gore and Paul Kennedy, “Overpopulation Threatens the Earth’s Future,” in 21st Century Earth (San Diego: Greenhaven Press, 1996), p 18. David Bender and Bruno Leone, senior editors.

² Ibid.

Notes

³ World Resources Institute web page, <http://www.igc.org/wri/wr-98-99/citygrow.htm>.

⁴ Gore and Kennedy, 18.

⁵ "A National Security Strategy for a New Century" (Washington, DC: Government Printing Office, October, 1998), 13.

⁶ Gore and Kennedy, 21.

⁷ Ibid., 19.

⁸ Matt Van Konyenburg, "The Urban Century: Developing World Urban Trends and Possible Factors Affecting Military Operations" (Quantico, VA: Marine Corps Intelligence Agency, 1997), 1.

⁹ Ibid.

¹⁰ Ibid.

¹¹ United Nations Press Release POP/684, "UN Releases 1998 World Population Estimates and Projections," on UN web site <http://www.undp.org/popin/pop684.htm>, 27 Oct 1998.

¹² Gore and Kennedy, 21.

¹³ Van Konyenburg, 1.

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Ibid., 2.

¹⁸ Ibid., 1.

¹⁹ Ibid., 2.

²⁰ Ibid.

²¹ Ibid.

²² United Nations Population Fund web page,
http://unfpa.org/modules/6billion/en/fact8_txt1.htm

Chapter 3

Military Operations on Urbanized Terrain

Ten years after the end of the Cold War, the US military is struggling to organize, train, and equip for the realities of 21st Century warfare. Although it has incorporated such concepts as parallel attack, information operations, and maneuver warfare, it remains largely oriented toward open-field mass formation operations. While this will remain an important role, the previous chapter indicates a need to prepare for urban operations as well.

While it is intuitively obvious that urban operations are different (e.g., tanks can't move in echelon formation on narrow streets), it is important to examine the specific differences and challenges. Many of the unique aspects of urban warfare were summarized in a Marine Corps Intelligence Agency (MCIA) study. The following were specifically identified:

- Geography. Multistory buildings obstruct line of fire and line of sight, hampering fire support, target acquisition, and short-range communications. Walls and cellars provide cover and concealment. Slums and shantytowns make maneuver very difficult.¹ The debris present in shantytowns, as well as overhead wires throughout urban terrain, are extremely hazardous to rotary wing operations.²

- Food. Shortages can cause riots or reliance on opposition forces. Nongovernmental organizations (NGOs) may be called in to supply food, which creates another entity requiring military security.³
- Disease and Pollution. Epidemics are prevalent in cities, since the population is forced into close proximity and services may be overwhelmed. The resulting maladies not only tax the military medical facilities, but also can take a severe toll on combat strength. Toxicity due to pollution can have similar effects.⁴
- Refugees. Movement and fire support are restricted when avenues of approach are overwhelmed by refugees. Hostile combatants can also blend in with the refugee population making friend or foe recognition problematic; rules of engagement become complicated and hamper small unit leaders' freedom of action.⁵
- Organized Opposition
 - *Guerrillas*: Urban resistance fighters present a significant asymmetric threat to US forces. They offset their disadvantage in firepower and technology with knowledge of terrain, local support, and effective low-level human resource intelligence.⁶
 - *Organized crime*. Although not politically motivated to fight US forces, criminal organizations have an interest in expelling US forces from their territory. They are usually better funded than their guerrilla counterparts and at least as violent.⁷
 - *Urban elites*. In some cases, an economic and political elite separate from the established government may be the real power in a city. The commander must

know with whom to negotiate and coordinate, and must avoid alienating a sector that controls his area of operations.⁸ An example is the wealthy class living in the suburbs of Port-au-Prince during US operations to restore the Aristide government in 1994.

- Weapons. Opponents in urban warfare are normally armed only with man-portable weapons.⁹ There are exceptions, such as the crew-served heavy mortars and “technical” operated by militias in Mogadishu in 1993.¹⁰ Man-portable weapons are observable when employed in open-field warfare, but can be concealed in clothing, behind children, or inside civilian vehicles in urban combat.¹¹ Weapons effects are accentuated in close alleys and along streets, where ricochets result in rounds travelling in all directions.¹² Urban fighters also adapt man-portable systems for new uses, as shown by the use of rocket-propelled grenades to shoot down US Army helicopters in Mogadishu.

Other Factors Complicating Urban Operations

Experience shows other functions that are more complex in urban environments than in open-field warfare.

- Close air support. Battlefield commanders at all levels rely on airpower to provide overwhelming fire when in contact or near contact with the enemy. There are few platforms, however, with the precision and discriminatory capability to engage targets in a city. Attack helicopters and AC-130 gunships are among the limited choices available.
- Imagery Intelligence. Commanders rely more on accurate overhead imagery in cities (for example, to evaluate avenues of approach and line of sight or line of

fire). This reliance is complicated by the simple fact that urban terrain changes more dramatically with combat than does open terrain. An artillery barrage will have slight effect on roads, hills, and fields. That same barrage, targeted on a city block, will completely change the landscape.

- Maps, Charts, and Geodesy (MC&G). MC&G products must be produced in finer detail for urban warfare, typically at a 1:25,000 scale or better. As more detail is printed on a map, the accuracy diminishes. That detail is essential, however. Another limitation is map coverage. The National Imagery and Mapping Agency has not prioritized urban coverage, so many cities do not have military-quality maps available.

Another problem is locational accuracy. In traditional operations it is permissible for a troop leader to know his position down to a ten-digit grid coordinate, or for a pilot to know his target's location down to a one hundred meters. This is unsatisfactory in an urban environment. According to Lts Edward Borowiec and Joshua Stevens, the margin of error for their GPS system in Haiti was 150 meters.¹³ Beacons used for intelligence purposes or rescue suffer from similar imprecision, although they are perfectly adequate in the environment for which they were designed.

- Communications. As mentioned above, vertical obstructions can hamper the use of line-of-sight communications. The Marine Corps study states “Dead spots in communications caused by urban structures that block or absorb signals...may cause communications loss of 10 to 30 decibels”; this shadowing “...increases with an

increase in frequency.”¹⁴ Electrical interference is also significantly higher in cities, “15 to 20 decibels higher than a rural or suburban environment.”¹⁵

- Force protection. For many of the reasons cited above, US forces will be considerably more vulnerable in urban terrain. Friend or foe identification is difficult in cities where adversaries can blend in with noncombatants. Additionally, snipers will be more numerous and more difficult to identify and target without collateral damage.

Revolutions in Military Affairs (RMAs)

Most of the complicating factors cited above have existed for years. There are new factors resulting from certain “revolutions in military affairs” which will have a more profound impact.

An example is information warfare. Commanders in the next century are likely to target computer servers, telephone exchanges, and other information hubs. They will use kinetic weapons as well as computer viruses and electromagnetic surges. Many of the targets will be located in cities.

Precision weapons will aid in prosecuting wars in urban terrain. Recent action in the Persian Gulf highlighted the efficacy of using cruise missiles in crowded cities. However, these weapons will require precise targeting information in order to be effective.

Operation DESERT STORM introduced the concept of parallel attack. This entails simultaneous strikes at tactical, operational, and strategic targets rather than sequential operations against fielded forces in contact. Most of the strategic targets will be located in capitals and other major cities.

The Case is Strong

Preceding chapters indicated an increased likelihood that twenty-first century wars will occur on urban terrain. The present chapter highlighted the unique aspects of this terrain that complicate operations, as well as new trends that must be addressed. The case is strong that the US military must examine its posture for urban operations and adapt accordingly.

Notes

¹ Matt Van Konyenburg, “The Urban Century: Developing World Urban Trends and Possible Factors Affecting Military Operations” (Quantico, VA: Marine Corps Intelligence Agency, 1997), 3.

² Personal observation by the author in planning and executing operations in Port-au-Prince, Haiti and Mogadishu, Somalia.

³ Van Konyenburg, 3.

⁴ Ibid., 5.

⁵ Ibid., 6.

⁶ Ibid.

⁷ Ibid., 7.

⁸ Ibid., 8.

⁹ Ibid.

¹⁰ Personal observation. The author was assigned to Task Force Ranger and served as a liaison officer to US Central Command.

¹¹ Van Konyenburg, 8.

¹² Ibid.

¹³ Ibid., 4.

¹⁴ Ibid., 9.

¹⁵ Ibid.

Chapter Four

Urban Operations: Tactical Emphasis, Operational Void

The distinction between the tactical and operational levels of war blurs in the urban environment. First, the congestion of population and potential for collateral damage results in what one observer calls, “the tendency of tactical decisions to have operational impact,” due in part to “the CNN effect.”¹ Second, a JFC’s entire area of operations may be confined to a city, with outlying areas merely an area of interest. This also makes it difficult to determine what are tactical decisions and what are operational. Perhaps because of this blurring of the boundaries, the majority of thought on urban operations has been at the tactical level.

US Army doctrine for urban operations is contained in Field Manual 90-10 (FM 90-10), Military Operations on Urbanized Terrain (MOUT). The first sentence in the manual indicates the mindset of the Army toward fighting in cities: “Tactical doctrine stresses that urban combat operations are conducted *only* when required and that built up areas are *isolated* and *bypassed* rather than risking a costly, time-consuming operation in this difficult environment” (emphasis in original).² The subject in which FM 90-10 excels is combat skills for the individual soldier. Specifically, the manual devotes a chapter to weapons effects³ and one to selecting and preparing defensive positions.⁴

Besides FM 90-10, two other publications provide extensive treatment of urban warfare as a separate discipline. The first is FM 31-130, Intelligence Preparation of the Battlefield. This field manual devotes an entire thirty-six page appendix to the unique requirements and challenges of conducting IPB in urban environments. Many of the problems outlined in Chapter Three of this paper are mentioned in this appendix: MC&G limitations, rapidly changing terrain, and debris for example.⁵ Other urban-unique aspects of IPB covered in FM 34-130 include terrain analysis, weather analysis, threat evaluation, and threat integration.⁶ These subjects are, of course, all tactical in orientation rather than operational.

A second manual that devotes special attention to urban operations is Training Circular (TC) 31-29, Special Forces Operational Techniques. The Special Forces branch recognizes that many of the missions that take place in cities will fall to them; this has prompted the branch to evaluate the environment carefully. Like FM 90-10, the most informative sections of the chapter on Operations in an Urban Environment focus on the small unit level (e.g., movement, use of grenades, fighting positions, and assaults).⁷

Field Manual (FM) 100-5, Operations, mentions the urban environment as a geographic dimension that presents “unique and complex challenges to Army forces.”⁸ For example, “they can constrain technological advantages; they impact on battle tempo; they force units to fight in small, decentralized elements; they also create difficult dilemmas due to the proximity of large numbers of civilians.”⁹

These publications are currently in circulation. However, the Army has several efforts underway to update urban warfare doctrine that will help bridge the gap between FM 90-10 and the future. These include the Army Dismounted Battlelab (part of the

MOUT Advanced Concept Technology Demonstration)¹⁰, urban exercises at the Joint Readiness Training Center at Ft Polk, LA¹¹, and designating the 10th Mountain Division as a Center of Excellence for urban warfare lessons learned.¹² Once again, these initiatives are intended to improve tactical capability, and essentially ignore the need for operational level ingenuity.

Marine Corps emphasis on urban warfare is a recent development, as the Corps has migrated from its amphibious-centered orientation to an all-environment crisis response force. Because this change in emphasis is relatively new, urban operations are not covered in doctrinal publications such as Marine Corps Doctrine Publication (MCDP) 1, Warfighting,¹³ or MCDP 1-2, Campaigning.¹⁴ This will change in the near future, as the Marine Corps has several initiatives underway which will identify and address the new realities facing the Marine while fighting in the city. These include the previously mentioned MOUT ACTD, as well as the URBAN WARRIOR exercise series that tests the Corps' effectiveness in the urban environment.¹⁵ Like the Army, the Marine Corps' emphasis is on improving the skills of the individual-not on planning at the operational level.

The Navy's vision for the next century is to move from a primarily open water force to a means of projecting power ashore.¹⁶ With the urbanization trends mentioned earlier, one would expect such a shift in Navy emphasis to include doctrine on support to urban operations. However, this is not presently the case. The Navy's "Force 2001" document identifies four core competencies: command and control, battlespace dominance, power projection, and force sustainment. However, descriptions of these competencies do not address how the Navy will support urban operations.¹⁷

The central doctrinal publication for the Air Force is AFDD-1, Air Force Basic Doctrine. AFDD-1 does not appear to acknowledge the unique aspects of urban operations. In fact, AFDD-1 categorizes warfare “by intensity (low to high); by duration (short or protracted); by the means employed (conventional, unconventional, nuclear); or by the objectives and resources at stake (general or limited war).”¹⁸ It does not categorize warfare by operational environment, such as urban, mountainous, desert, etc. This seems to indicate that airmen recognize no difference in the application of airpower in cities as opposed to open desert.

Because of this, there are no Air Force publications dealing specifically with urban operations. However, the Air Force is beginning to acknowledge that it has a greater role in urban operations than many realize.¹⁹ Indeed, the Air Force was the first service to push the Joint Staff toward developing operational level doctrine for urban operations,²⁰ and has taken the lead role in writing a JTF Handbook for urban warfare.²¹

Joint doctrine in urban operations has been slow in coming. No need was seen in the past, since Army and Marine Corps doctrine were identical.²² The tactical focus of this shared doctrine ensured that any “joint” thinking was directed at that level. However, a study by the Joint Staff J-8 has identified the gap in operational level thinking in urban warfare as a weakness in joint doctrine. The J-8 is now focusing its efforts on filling the void.

Thinking Operationally In the Urban Environment: Centers of Gravity

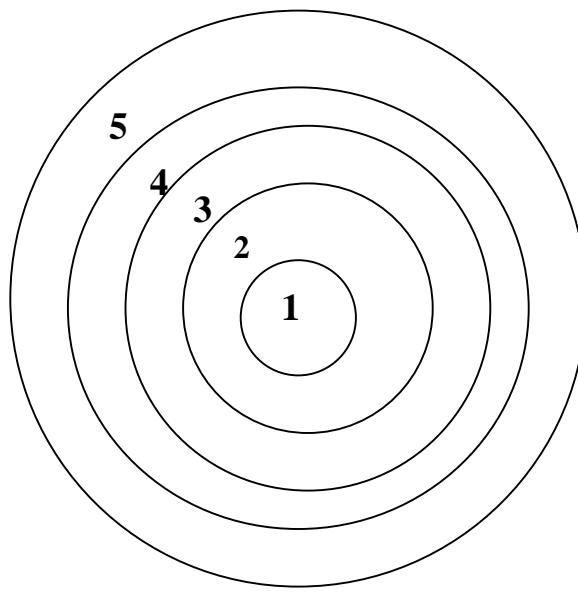
Developing urban warfare skills at the small-unit level is a waste of time if we do not ensure that our strategy is congruent with our objectives. The key to congruency is to identify entities that enable our adversary to resist our will. These entities are called

centers of gravity (COGs). It is the task of the operational-level planner to take his commander's intent and identify which COGs should be targeted in order to meet his objectives. One method of doing so was developed by Colonel John Warden, and is known as the Five Ring Model.²³ Warden's model is only a first step, though, in the identification of COGs and does not suffice for developing operational level courses of action. It must be followed by detailed nodal analysis in order to develop specific target sets.

The central premise of Warden's theory is that all systems are composed of subsystems, and these subsystems relate to each other in a predictable manner. According to Warden, "this is very important to us as military planners because it allows us to develop general concepts not dependent on a specific enemy."²⁴ This enables a methodological approach to COG identification. Warden then shows how this aids in ensuring congruity between objectives and strategy: "Understanding centers of gravity then allows us to make reasonable guesses as to how to create costs which may lead the enemy to accept our demands."²⁵

Figure 1 shows Warden's five rings. At the center is leadership.²⁶ Leadership could mean an adversary's government, a specific individual, or any other entity with the decision-making authority to direct the system to respond to your will.²⁷ The next ring is "organic essentials," those commodities without which the system cannot operate. As an example, Warden cites energy and money as organic essentials for a state.²⁸ Next comes infrastructure, the entities which are necessary for the subsystems to interact (such as roads, electric transmission lines, or airfields).²⁹ The fourth ring is "population," the group necessary to carry out the leadership's will but not possessing decision-making

authority.³⁰ Finally, fielded forces are those entities that protect the system. This could include combat units, firefighters, repair technicians, and so on.³¹



1. Leadership
2. Organic essentials
3. Infrastructure
4. Population
5. Fielded Forces

Figure 1 Warden’s Five Ring Analytical Tool

In applying this tool at the operational level, the JFC’s staff examines the enemy as a system composed of the five components.³² In doing so, they identify the individual elements of each ring, enabling them to examine relationships among them and between the rings. This aids in the identification of key nodes that, if affected, will have cascading effects throughout the system.

As previously stated, Warden's Five Ring Analysis does not complete the process – it is only a beginning step. At this point, each of the nodes, in turn, is analyzed to determine what essential component can be affected in order to influence the entire node, initiating the cascading effect throughout the system. The most important aspect of this task is to keep the commander's intent and desired end state in mind.

Types of Urban Operations

There are scores of mission types that could be assigned to an urban JFC commander. Three which stand out, however, are noncombatant evacuation operations (NEOs), apprehension of individuals, and affecting a nuclear weapons production capability.

NEOs stand out because they are the most frequently conducted urban operation. In the period 1996-1997, Special Operations Command Europe alone conducted NEOs in Albania, Liberia, Central African Republic, Congo, Zaire, and Sierra Leone.³³ NEOs also involve the protection of American civilians as well as noncombatants of our allies, therefore having a direct impact on our national interests. NEOs are complicated by the variety of environments in which they occur: hostile, semi-permissive, or permissive. Each environment dictates a different approach at the operational level, and the environment can vary during the course of the operation or in different areas. NEOs also vary in terms of the nature of the adversary. In some instances, the adversary will be an insurgent group. Other times, it will be the seated government, or even the government and insurgents. In many cases, the “adversary” will be anarchy, in which the threat comes from armed looters and thugs rather than any organized group. These factors make operational level analysis very complex.

Apprehension of individuals is a relatively recent task. Operation JUST CAUSE was the first large scale apprehension operation for US forces. Since then, we have attempted similar operations in Mogadishu against Mohammed Farah Aideed, and in Bosnia against indicted war criminals (in concert with the UN). Future operations could be targeted at leaders of terrorist organizations or criminal cartels, thus directly targeting those who threaten vital US interests. Experience has shown these operations to be quite different from NEOs. They involve locating one individual, in native territory, surrounded not only by fielded forces but by an entire population which is sympathetic.

Attacking a nuclear weapons production capability has yet to emerge as a frequent task. It is included because of the gravity of the mission, and because the five ring analysis of such an operation differs greatly from more common tasks. Few missions could be more vital to national interests than disabling a nascent nuclear threat to the US and its allies.

The next three chapters will deal in turn with these three representative mission types. Warden's Five Ring Model and subsequent nodal analysis will enable us to look beyond the tactical considerations and focus on operational level decision making for these urban operations. Although each chapter will determine specific targets for typical missions, the important product is the procedure, not the outcome.

Notes

¹ LtCol Dwayne Schattle, USMC, Joint Staff J-8. "Joint Urban Operations." Lecture presented at the Air Command and Staff College, 10 March, 1999.

² Field Manual 90-10, Military Operations on Urbanized Terrain (Washington, DC: Headquarters, Department of the Army, 15 August 1979, 1-1.

³ Ibid., B-1 through B-10.

⁴Ibid., C-1 through C-12.

Notes

⁵ Field Manual 34-130, Intelligence Preparation of the Battlefield (Washington, DC: Headquarters, Department of the Army, May 1989), B-8.

⁶ Ibid., B-3 through B-28.

⁷ Training Circular 31-29, Special Forces Operational Techniques (Washington, DC: Headquarters, Department of the Army, 9 Sep 1988), 6-1 through 6-21.

⁸ FM 100-5, Operations (Washington, DC: Headquarters, Department of the Army, June 1993), 14-4.

⁹ Ibid.

¹⁰ Military Operation in Urban Terrain Advanced Concept Technology Demonstration (MOUT ACTD) Homepage, <http://yorktown.dc.isx.com/mout/>. The Army and the Marine Corps have pooled resources to examine technological innovations that can improve effectiveness in urban combat. They formed the MOUT ACTD "...to demonstrate the military utility of new technologies combined with operational concepts that will increase the lethality, survivability, mobility, and command and control capabilities of soldiers and Marines operating in an urban environment." MOUT ACTD is a joint effort of the Army Dismounted Battlelab at Ft Benning, GA and the Marine Corps Warfighting Laboratory at Quantico, Va. Its focus is on the small-unit level problems of urban warfare.

¹¹ Gen Dennis Reimer, lecture presented in the Commandant's Speaker Series, CS-506, Air University, 3 Feb 1999.

¹² Ibid.

¹³ Marine Corps Doctrine Publication 1, Warfighting (Washington, DC: Headquarter, U.S. Marine Corps, 20 Jun 1997)

¹⁴ Marine Corps Doctrine Publication 1-2, Campaigning (Washington, DC: Headquarters, U.S. Marine Corps, 1 Aug 1997).

¹⁵ Schattle.

¹⁶ Force 2001: Vision...Presence...Power (Washington, DC: Deputy Chief of Naval Operations, Resources, Warfare Requirements, and Assessments (N8), 1997), 10.

¹⁷ Ibid.

¹⁸ Air Force Doctrine Document (AFDD) 1, Air Force Basic Doctrine (Maxwell AFB, AL: Air Force Doctrine Center, 1997), 7.

¹⁹ The Air Force does have unique capabilities to offer, however. For example, the AC-130 gunship can provide very accurate fire support using a combination of 105mm, 40mm, and 25mm armament. It also possesses sophisticated radar and night vision equipment which can aid forces on the ground in urban terrain. Its utility in the urban environment was demonstrated during Operation JUST CAUSE, when it was used to destroy the Commandancia building in Panama City. In his book Air Commandos, Randy Jolly describes just how useful the AC-130 was. "Even though the compound was situated in a heavily populated area, post battle surveys...certified that 'the headquarters compound was virtually obliterated while adjacent structures received little or no damage at all.'"

²⁰ Ibid.

²¹ Ibid. This handbook is due to be published in the summer of 1999.

Notes

²² Ibid.

²³ John A. Warden III, “Air Theory for the 21st Century,” in War Theory (Air Command and Staff College coursebook; Maxwell AFB, AL: Department of War Theory and Campaign Studies, Air Command and Staff College, Sep 1998), 288.

²⁴ Ibid., 287.

²⁵ Ibid.

²⁶ Ibid.

²⁷ Ibid., 289.

²⁸ Ibid., 287.

²⁹ Ibid.

³⁰ Ibid.

³¹ Ibid.

³² While Warden uses these five rings, an operational level staff can substitute other rings that they feel are more appropriate for mission analysis in their particular situation.

³³ United States Special Operations Command Posture Statement (Tampa, FL: U.S. Special Operations Command, Office of Public Affairs, 1998), 28.

Chapter Five

Noncombatant Evacuation Operations

Noncombatant Evacuation Operations (NEOs) differ from most military operations in the nature of the adversary, proximity to civilians, and (usually) urban nature of the terrain. These factors become evident when performing a five-ring analysis.

In this chapter, NEOs will be examined from the JFC's perspective. The first step will be to perform Warden's analysis, identifying all potential COGs in the system. The five ring analysis for a NEO is shown in Figure 2. Those that can most easily be influenced in order to achieve the desired end state will be broken down further in order to identify key components which should be targeted.

Leadership

An adversary in a NEO can take several forms. Often there are many factions fighting each other who directly or indirectly target Americans. This was the case in Operation EASTERN EXIT (Mogadishu, 1991). NEO planners had to consider three separate rebel organizations plus the government as potentially hostile.¹ The situation was even more complex during the evacuation of the US embassy in Monrovia, Liberia, in 1996. In that case, there were six different factions fighting for control of the country.² Therefore, the central figures of each faction must be considered potential COGs in a NEO. If a government is still in existence, its leader and cabinet can also be a COG if the

government does not want the US to evacuate its citizens. Somalia, again, provides an excellent example. "...A Somali major approached the gate with two truckloads of troops and threatened to shoot down the helicopters if the 'illegal operation' did not cease immediately...He withdrew his opposition ...in return for several thousand dollars in cash and some car keys."³ Another element of the leadership ring is command and control (C2). In order for the leadership to be effective, it must have some means of communicating its intent to fielded forces.

Organic Essentials

Regardless of the number of factions, certain organic essentials will be common in a NEO. First, weapons and ammunition will be necessary for the adversaries to resist our will and prevent the desired end state. Cities are usually awash in weapons by the time a NEO is directed, including not only small arms but often rockets and crew-served weapons.⁴ Fuel is usually an organic essential as well. Factions require mobility in order to respond to US actions and influence the operation, yet fuel is often in short supply during these chaotic situations. Food and water also become scarce, yet essential, commodities without which factions cannot fight.

Infrastructure

The conditions that bring about the call for a NEO often bring with them the decline of the urban infrastructure. Control of the remaining elements can become crucial to control of the city. For example, electricity is required to power sanitation facilities, medical facilities, the communication network, TV, radio, and other opinion-shaping outlets, and of course lights. The communication network itself is an element of the infrastructure that enables command and control of faction forces. Take away a leader's

radios, telephones, and cellular phones, and he will not be able to organize and direct his fielded forces to resist US will. Roads, as a high-speed avenue of approach, will often be key to defending an assembly or evacuation area. During operations to evacuate Monrovia, the UN Drive was identified as “the primary threat area to the (embassy) compound.”⁵ TV, radio, and newspapers are an important element of infrastructure as well. Whoever controls the media has a distinct advantage in molding the opinion of the population to support their end state. Finally, medical facilities will be very important during NEOs. There will likely be a great deal of shooting resulting in heavy military and civilian casualties. These will probably overwhelm the system. In the hands of insurgents, medical care may be directed only to their combatants. Lack of treatment can be used as a weapon to intimidate and control the population. In the hands of US or friendly forces, medical facilities can augment US capabilities and be used to help restore order and normalcy.

Population

In a NEO, there are two elements that may be a center of gravity. First, the segment that sympathizes with a combatant faction. They can provide intelligence, food, shelter, safe houses and other benefits to those opposing US action. They can also be used as a “human wave” to overwhelm US forces. Their influence must be neutralized, but since they are noncombatants, this must be accomplished through passive or nonlethal means.

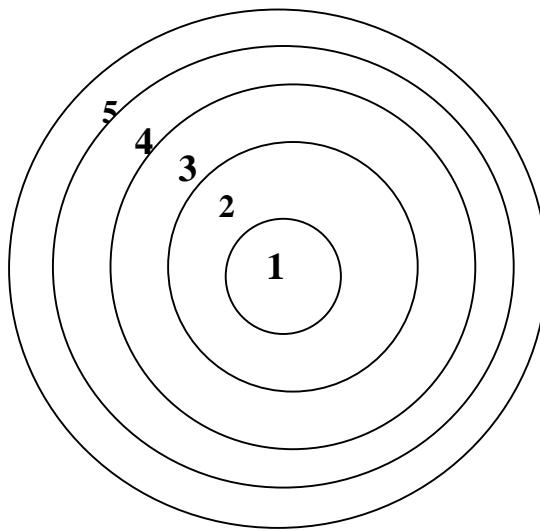
The other element is the population at large that does not actively support any of the warring factions. Their sheer numbers can make their presence a center of gravity: prior to ASSURED RESPONSE, the Ambassador estimated “as many as 10,000 Liberians in

the vicinity of the compound.”⁶ This segment of the population must be influenced to remain calm and not support those who would resist US evacuation.

Fielded Forces

Fielded forces are those entities that protect the adversary system. This obviously includes the individual fighters belong to the various factions. If the government is resisting US action, it could also include their army, police, and fire department.

Another potential COG (and almost unique to urban operations) is the presence of looters. Looters are often armed and difficult to control. In Mogadishu on 4 January 1991, a gunfight broke out between the US Embassy Marine guards and looters intent on entering the compound.⁷



- 1. Leadership:** Faction leaders, government cabinet, C2
- 2. Organic Essentials:** Weapons, ammunition, fuel, food, water
- 3. Infrastructure:** Electricity, phone, roads, TV/radio/newspapers, medical facilities
- 4. Population:** Faction sympathizers, general population
- 5. Fielded Forces:** faction fighters, army, police, fire, looters

Figure 2 Five Ring Analysis of a NEO

Key Centers of Gravity

The JFC will not have the luxury of controlling all potential centers of gravity listed above. He will be constrained in both time and resources. It is up to his staff to identify the key COGs that can be influenced so as to meet the JFC's intent and desired end state.

The following criteria should be used in selecting COGs:

1. They should be instrumental in bringing about the desired end state.
2. They should provide the most effect for the least effort, and preferably cause cascading effects throughout the system.
3. They should achieve this effect in the quickest manner, due to time constraints.
4. They should require the JFC's forces to occupy as small amount of the city as possible, due to constraints on resources.
5. They should result in the fewest casualties (friendly, enemy, or noncombatant).

The fifth criterion takes on increased significance in a NEO compared to the types of operations discussed in the following chapters. Casualties during a NEO are considered a sign of failure, and the JFC's intent (or the intent he receives from the strategic level) may in fact specify "no casualties" as a measure of success. This limits the options available to the operational level planners.

With these criteria in mind, there are two key centers of gravity, control of which will allow the JFC to achieve his objectives. They are the factional fighters and roads. The factional fighters present the most immediate threat to the JFC's forces, as well as evacuees and population. Influencing them will contribute directly to the desired end state of an orderly evacuation. The effect will be immediate, since the JFC will not have to wait for his actions to work through the system down to the individuals resisting his effort. The roads, as previously mentioned, are often the greatest area of threat to the

NEO force. Control of roads allows rapid movement from assembly area to evacuation site, or if controlled by the adversary, rapid movement of forces to areas of fighting. In order to limit the area under the JFC's control, only those roads connecting the assembly area, evacuation site, and other key locations should be held.

Nodal Analysis of Factional Fighters

Viewing the factional fighters as a system, one sees the various key nodes that are essential to the fighters' ability to influence the battlespace. First, they require some sort of **leadership** to issue orders to move, fight, and disengage. Some sort of **command and control** is required for that direction to be passed from the leadership. **Vehicles** form a second node, providing mobility that enables the fighters to influence different areas of the urban environment. The vehicles, in turn, require **fuel** to run. **Weapons**, of course, are essential to the fighters' ability to resist our will. The weapons require **ammunition** to be effective. A final, less tangible node, is **will**. The fighters may be directed to engage, move to the area, and have the weapons to fight, but if their will to resist is weakened, they will not threaten the US operation.

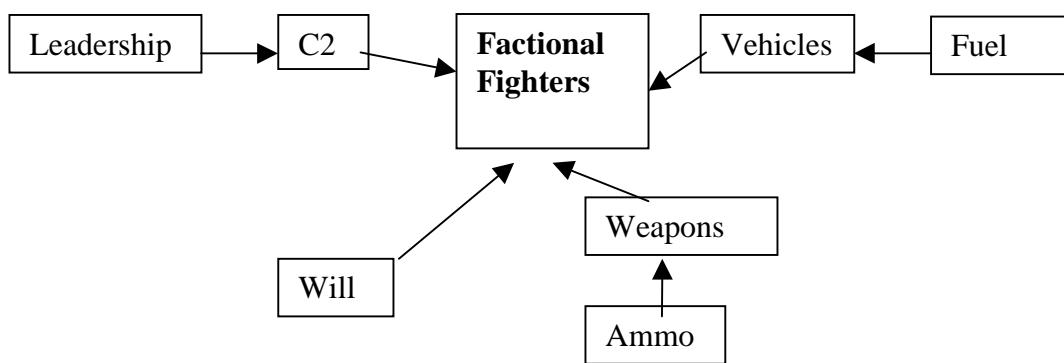


Figure 3 Nodal Analysis of Factional Fighters

Of these nodes, the operational level planner should target the enemy's will. If their leadership or C2 capability is compromised, the fighters might still function on their own or take direction from a lower-level, on-scene commander. Affecting vehicles would take more time than the JFC has to accomplish his mission, and differentiating threat vehicles from those operated by the general population or NGOs could be difficult. In order to affect the weapons node, the JFC would probably destroy ammo caches. However, this would leave the basic load carried by the fighters.

Will, however, can be affected quickly at the immediate location. The most direct method would be a demonstration of overwhelming firepower. A large portion of the JFC's ground component should be deployed very visibly to send the message that US forces possess the means to destroy the fighting faction if necessary. Air assets, such as helicopter gunships or fixed-wing assets, add a third dimension to the sense of envelopment experienced by the factions. Another tool would be loudspeaker teams or other PSYOP assets available to the JFC through his Joint Psychological Operations Component Commander or Joint Special Operations Component Commander. Using the variety of tools at his disposal, the JFC commander can break the will of the fighters to threaten US interests.

Nodal Analysis of Roads

The second node that the JFC should control is the road system, specifically the roads connecting the assembly area to the evacuation site, plus any other key locations. The operation will not be safe if the JFC's forces do not have complete control of these lines of communication.

Several components comprise the road system. First, the roads are lined with buildings, and each building has the potential to be a hide site for an ambush or a sniper. Traffic flow is controlled by signals, which are dependent on electricity and switching equipment to direct their operation. A central control facility directs the flow through

these signals. The most obvious component is the pavement itself, or asphalt, dirt, etc. A road surface must be physically capable of supporting vehicles and clear of obstructions. Finally, intersections provide high speed access to the roads, providing an avenue of approach for the enemy.

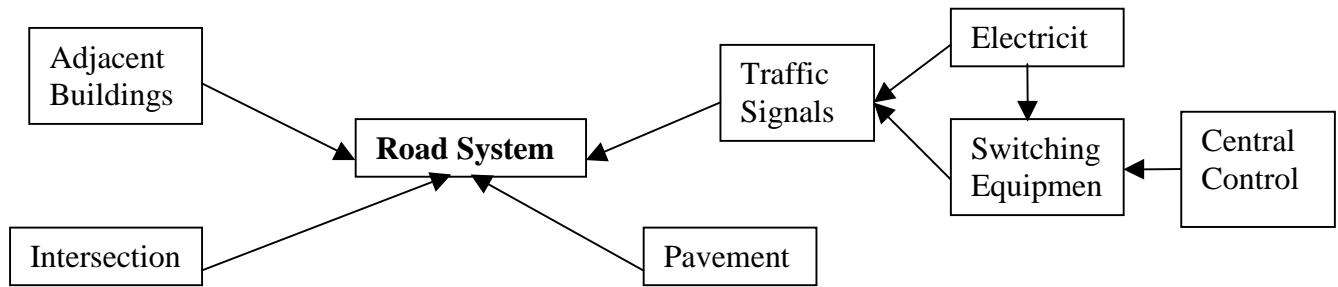


Figure 4 Nodal Analysis of Road System

Of these nodes, the JFC should concentrate on adjacent buildings and intersections. Traffic signals, important during normal activity, are of no significance during a NEO. Pavement or road surface condition can be very important to the JFC's movement plan, but he does not have the time to repair roads that are in need. Adjacent buildings, however, cannot be ignored. Any unsecured location can lead to a surprise attack that not only inflicts casualties, but also stops the operation. Intersections, likewise, enable a threatening force to close on the evacuees and task force, inflicting damage and ending the operation.

Conclusion

This chapter has looked at generic NEOs and how an adversary could be composed as a system. The nature of the system is very different from other operations: it is

composed of fewer physical entities that can be targeted. Casualty avoidance has a much larger impact on operational level planning for a NEO than for other operations.

A five ring analysis determined that key centers of gravity in a NEO are the factional fighters and the road network. Within these nodes, the JFC should target the will of the fighters, and the adjacent buildings and intersections of the roads between assembly and evacuation sites. These conclusions are all general in nature. Each real-world event will have different nuances that may affect COGs and key nodes.

Notes

¹ Adam B. Siegal, Eastern Exit: The Noncombatant Evacuation Operation (NEO) from Mogadishu, Somalia, in January 1991 (Alexandria, VA: Center for Naval Analyses, Oct 1991), 7.

² John W. Parkin and Rob Rhoden, Operation ASSURED RESPONSE: SOCEUR's NEO in Liberia, April 1996 (Tampa, FL: United States Special Operations Command History and Research Office, Sep 1997), 1.

³Siegal , 4

⁴ Partin and Rhoden, 21-22.

⁵ Ibid., 22.

⁶ Ibid., 1

⁷ Siegal, 2.

Chapter Six

Apprehension of Individuals

The US military does not normally target an individual. Such cases usually involve bringing to justice a person who is indicted for a crime in the US or by the International Court of Justice. As such, these are normally considered to be the purview of legal authorities.

Since the end of the Cold War, this mission has taken on increasing importance. In December 1989, a massive operation was conducted to apprehend Gen Manuel Noriega, president of Panama, who had been indicted for crimes in the United States. Control of the country was won in a matter of hours, yet it was several days before Noriega was found and spirited away. The next attempt failed to catch the wanted individual. Mohammed Farah Aideed was leader of the most influential clan in Mogadishu. He was wanted by the UN for allegedly ordering attacks on its forces that were deployed to Somalia to stabilize the country and provide relief. Despite the employment of night vision devices, ground surveillance radars, airborne reconnaissance, and other sophisticated intelligence systems,¹ Task Force RANGER never had a precise location for Aideed in a timely enough manner to allow his apprehension. Locating a key leader in his native territory, especially in an urban environment, turned out to be very difficult

using techniques and equipment designed for the Cold War. In the end, he was never apprehended.²

The future presents many situations that may lead to US military action to apprehend a wanted criminal. There are eighty persons indicted for war crimes (PIFWCs) in Bosnia³, and NATO forces have been used in the past to apprehend some of the twenty-five presently in custody.⁴ Terrorists such as Osama bin Ladin present other potential targets for US military apprehension operations.

Five Ring Analysis

Leadership. The innermost ring for an apprehension mission will center on the targeted individual. In all likelihood he will be surrounded by a second-tier decision-making body, the composition of which will vary. If the fugitive is a government leader, like Noriega, this could be a formal structure such as a cabinet. A faction leader such as Aideed may have an inner circle that is less formal, but nonetheless an important decision-making body. In fact, Task Force RANGER considered Aideed's inner circle an important center of gravity and targeted his lieutenants with a large degree of success.⁵ In other cases, such as individual terrorists, the inner circle may be small or nonexistent.

Organic Essentials

In order to resist a US apprehension mission, certain commodities must be on hand. First, the fugitive and his supporters must have weapons available. Again, the weapons available vary with the situation. A single terrorist may only have access to a personal weapon, while a government leader can employ all weapons in his arsenal. The weapon systems must also have ammunition. During Task Force Ranger's operations on 3 October 1993, Aideed's forces seemed to possess an inexhaustible supply of rocket-

propelled grenades (RPGs), and were able to inflict severe damage not only on ground forces but on helicopters as well.⁶

Another crucial commodity is information. The fugitive is often in native territory, giving him two distinct advantages. First, a knowledge of the urban terrain. He knows chokepoints, ambush sites, hide sites, and the fastest means to move about. Second, he likely enjoys the support of a segment of the population, which can serve as a HUMINT source or provide advance warning of unusual preparations by the JFC's forces. In many cases information will be the area in which the fugitive enjoys the greatest superiority over the Joint Task Force.

Infrastructure

Certain elements of the urban infrastructure can play a crucial role in an apprehension mission. The fugitive and his inner circle will often rely on the communications system, not only to pass instructions, but also to fully exploit his information advantage. His HUMINT and early warning sources must be able to report to him, and will rely on a communications network to do so.

Electricity may also prove essential. Electricity is needed to run the communications system, as well as to provide lights. Effective lighting can significantly degrade the fugitive's vulnerability to surprise. If the fugitive is part of a sophisticated group or government, he may depend on computers or other equipment that requires electrical power.

Roads provide mobility to the fugitive. Control of roads increases his range of action and therefore the portion of the city that the JFC must control. Since the JFC is time- and resource-constrained, the smaller the area he must control the better.

Airfields, in some cases, are a center of gravity because they are the final means the fugitive has of escape. During Operation JUST CAUSE, the major airfields were seized by the JTF and special operations forces disabled Noriega's personal aircraft.⁷

Population

The fugitive's followers or fellow group members are the first population the JFC should consider. They will provide information and safe haven to him and hinder US operations. They are linked to him by the communications infrastructure and are a source of a great deal of his information organic essential. Any attempt to influence these noncombatants must be nonlethal or passive.

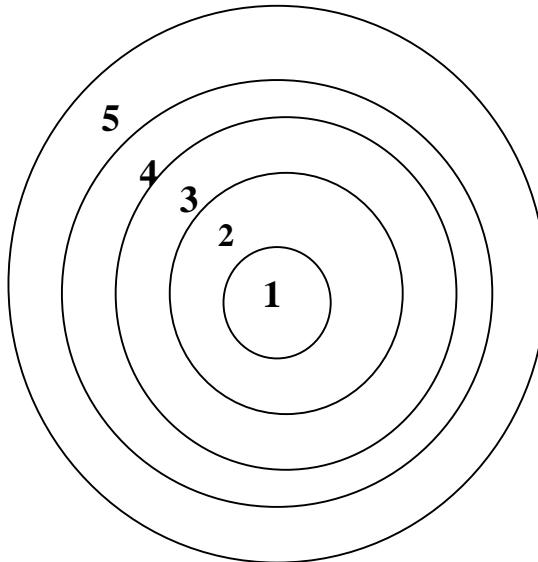
The general population must also be considered. They may or may not be sympathetic to the fugitive. In some cases, nonsympathetic citizens will support him out of antipathy for "the foreign invaders." The JFC should decide if the general population is a COG for his particular mission, and if so, use informational means to neutralize their interference.

Fielded Forces

Once again, the nature of fielded forces will vary depending on whether the fugitive is a single terrorist or leader of a well-established organization. In most cases, however, there will be some sort of personal guard. In Noriega's case, the Dignity Battalion served as a sort of Praetorian Guard beyond his own close-range bodyguards. If the fugitive knows he is targeted by US forces, his personal guard will probably be augmented and on heightened alert.

In cases where the wanted individual is part of the local government, he will probably use the police and military as a fielded force. In those instances when the

fugitive is part of an extragovernmental movement, a militia may take on the same role. Aideed's militia, formed from members of his clan, provided very effective resistance to US efforts to apprehend him.



1. **Leadership:** Fugitive, inner circle
2. **Organic Essentials:** Weapons, ammunition, information
3. **Infrastructure:** Communications, electricity, roads, airfields
4. **Population:** Followers, general population
5. **Fielded Forces:** Personal guard, police, military, militia

Figure 5 Five Ring Analysis for Apprehension Mission

Key Centers of Gravity

The essential task for the JFC's planners would be to neutralize the fugitive's informational advantage. This is the one arena in which the JTF doesn't enjoy a clear advantage, yet the fugitive's superior situational awareness can outweigh the JTF's advantages and enable him to resist our desired end state.

Which potential COG's should be targeted in order to neutralize the fugitive's informational superiority? Although a great deal of information is derived from

sympathizers in the population, directly targeting them may be ineffective and time-consuming (although a PSYOP campaign against them would be a helpful supporting operation). Instead, the **communications network** which passes information from the sympathizers to the leadership can be disrupted quickly, and have the added advantage of shutting down the leadership's means of direction and control.

Nodal Analysis of the Communications Infrastructure

In most urban environments, the communications structure will be extremely complex. However, disabling a few key nodes can have the effect desired by the JFC.

The first thing to realize is that the “communications infrastructure” includes several components that may or may not relate to each other. These are radio, landline telephone, cellular telephone, and satellite telephone. As long as any of these components are operational, the fugitive will probably be able to communicate with his information sources and direct his fielded forces.

Radio

The simplest of the four systems to neutralize is radio. The JTF/J2 can easily determine, through ELINT sources, the frequencies on which the fugitive's net is operating. Shutting down the radio net is as simple as jamming these frequencies. There are certain considerations, though. First, jamming affects all who use those frequencies in the urban environment. The JFC needs to be informed of any political fallout of affecting non-targeted communications. Second, the JTF/J2 must consult the J6 to ensure that jamming does not affect any friendly comms.

Landline Telephone

A system of lines and nodes connects telephones in an urban environment. The system is called the Public Switched Network (PSN), and consists of the following components:

- Customer Premises Equipment (CPE), or the telephone and wiring inside a particular building
- Drop lines, which connect a particular structure to the system
- Distribution lines, which tie together several drop lines
- Feeder lines, which tie together several distribution lines
- Central offices, which are the switching hubs. Each central office controls a small section of the city.
- Trunk lines, which connect central offices to each other and to the long distance network⁸

Figure 6 presents a graphic representation of a typical PSN.

When a call is made between the fugitive and supporters, it originates with the caller's CPE. It travels through the drop, distribution, and feeder lines to the originator's local central office. At that point, switching equipment directs the call to the recipient's central office, from which it is passed through the appropriate feeder, distribution, and drop lines to the recipient's CPE.⁹ The key node is the central office. The most efficient method for the JFC to isolate the fugitive's landline communications is to disrupt his local central office's switching equipment. This can be done several ways. Obviously a bomb or cruise missile could achieve the desired effect. A more subtle method would be a computer virus that attacks the equipment controlling the switch.

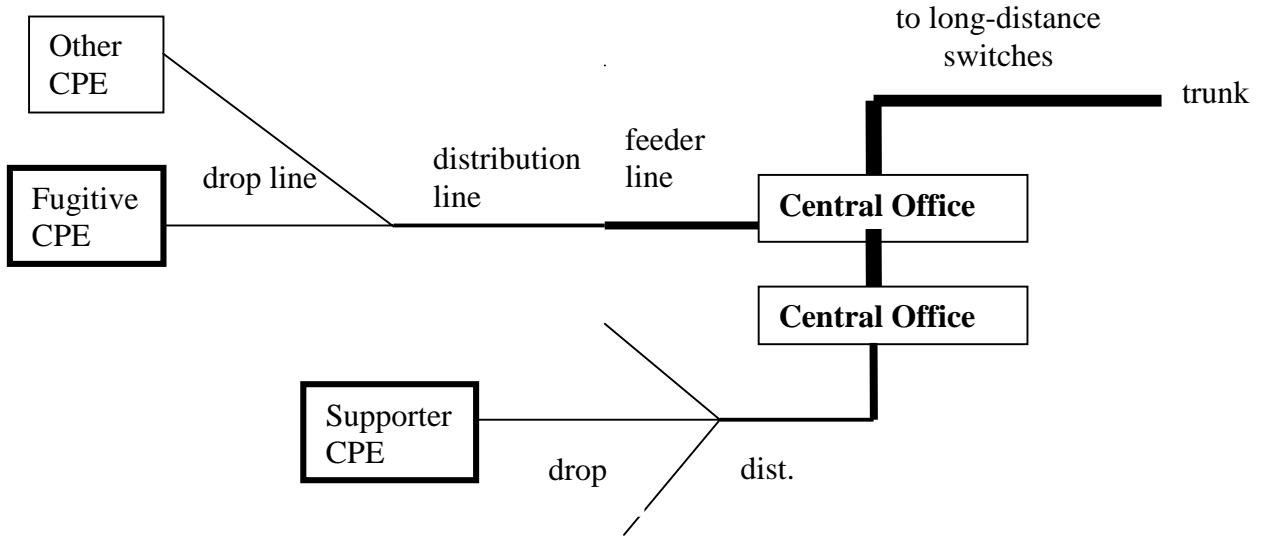


Figure 6 Nodal Analysis of a Typical PSN

Cellular Phones

Cellular phones are different from landlines because they use FM radio waves to carry information rather than physical lines.¹⁰ Although the information is being carried over FM frequencies and generated at low power,¹¹ a cellular system cannot simply be jammed like a radio net. Each cell operates on different frequencies, so the JTF would have to jam a large portion of the FM spectrum.

A cellular system is composed of the following components:

- The mobile subscriber unit (MSU), which is the cellular equivalent of the PSN's CPE
- Several cell sites
- The mobile telephone switching office (MTSO), which is the cellular equivalent of the central office
- In cases where a call is between a mobile and landline phone, the PSN¹²

Figure 7 shows a graphic depiction of this system.

A cellular call will vary slightly depending on whether both parties are on cell phones or if one is on landline. In a cell to cell conversation, the call begins with the originator's MSU. It is transmitted at low power over the "forward" (transmit) link to the nearest cell site, which passes it along repeaters to the MTSO. It is switched from there to the nearest cell of the recipient, and is transmitted over the "reverse" (receive) frequency to the recipient. In a case where one caller is on landline, the MTSO serves as the interface between the cellular network and the PSN.¹³

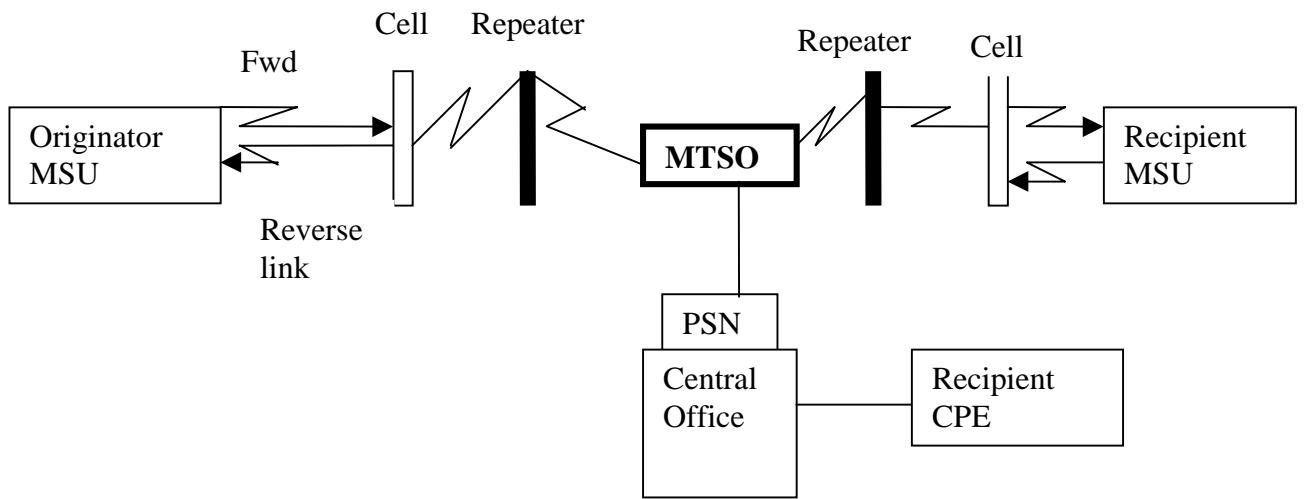


Figure 7 Cellular Phone Nodal Analysis

From this depiction the MTSO is clearly the key node that must be affected. It is not only the link between cellular phones, but from the cell system to any landline phones used by the enemy.

Satellite Phones

Satellite phone systems are very similar to cellular systems, with the obvious difference that satellites function as cells and repeaters. A typical system is shown in Figure 8.

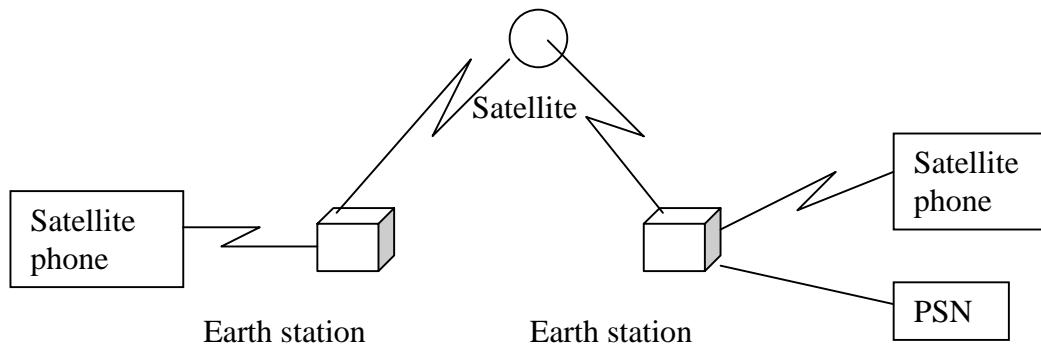


Figure 8 Satellite Phone Nodal Analysis¹⁴

In this case, the satellite and Earth stations serve too many customers to be prudent targets. However, the link between satellite phones and Earth stations are in a predictable frequency range (in the case of Iridium phones, between 1616 and 1626.5 MHz).¹⁵ Local jamming of the satellite to Earth station link would isolate the fugitive.

In summary, the fugitive can be isolated from his information base by disabling the communications infrastructure. However, all four systems must be affected. Radio net frequencies should be identified and jammed; the PSN central office closest to the fugitive's location should be shut down; the MTSO for his area of operations should also be rendered ineffective; and satellite phone frequencies should be jammed. The effects can all be localized in order to avoid disrupting friendly or neutral communications.

Notes

¹ Kenneth Allard, Somalia Operations: Lessons Learned (Washington, DC: Institute for National Strategic Studies, National Defense University, January, 1995), 74.

² Personal observations of the author, who served as a liaison officer from Task Force RANGER to US Central Command in September and October 1993.

³ UN International Criminal Tribunal for Yugoslavia, Suspects web page (<http://www.wcw.org/wcw/icty/suspects.html>)

⁴ Ibid.

⁵ Personal observation during tour as Task Force RANGER liaison officer.

Notes

⁶ Mark Bowden, *Blackhawk Down* (Philadelphia: Philadelphia Enquirer web site, <http://home.phillynews.com/packages/somalia/nov21/default21.asp>, Nov 1997), 4.

⁷ Class notes, Joint Special Operations Planning Workshop (USAF Special Operations School, Hurlburt Field, FL, Nov 1991), 12.

⁸ Public Switched Network Toolbook (Maxwell AFB: Air Command and Staff College Non-Resident Program, cd-rom, 1995), Chapter 2, Key Words Map.

⁹ Ibid.

¹⁰ “Demystifying Cellular,” on Cellular One web page (http://www.cellularone.com/pages/ref_center/ref_demystify.html, no date listed).

¹¹ IEC Cellular Communications Tutorial web page (<http://www.webproforum.com/nortel/index.html>, no date listed), 1.

¹² Ibid., Chapter 5, page 1 (<http://www.webproforum.com/nortel/topic05.html>)

¹³ Ibid.

¹⁴ Iridium Corporation web site, Technology page (<http://www.iridium.com/english/tech/index.html>)

¹⁵ Ibid.

Chapter Seven

Disrupting A Nuclear Production Capability

With last year's nuclear detonations in India and Pakistan, it is clear that the membership in the nuclear club is not static. The US has expended great effort to peacefully dismantle Iraq's nuclear weapons program. Other potential nuclear states include North Korea and Iran. Nuclear proliferation has become a high priority for this country, and weapons of mass destruction (WMDs) are one of three threats to US interests identified in the current National Security Strategy.¹ Since many of the elements of a nuclear weapons program will be found in urban environments, it is prudent to examine the operational level planning necessary to conduct urban operations to disrupt or destroy a rogue state's capability to produce these weapons.

Five Ring Analysis

Like all systems, a state's nuclear weapons production program can be examined using Warden's model.

Leadership

The leadership ring for a state-run nuclear weapons production program will center in the head of government. In rogue states (Iraq, Iran, North Korea) the head of government often is the final word on decisions of any importance, and that would certainly be the case for producing these weapons.

In states with these programs, there is usually an individual of unquestionable loyalty who is the director of the effort. His decisions will drive the type of weapon produced and the pace of effort.

Finally, the Ministry of Defense will often play a key role in developing the device, as well as in weaponizing it and acquiring delivery systems.

Organic Essentials

The most important organic essential for a nuclear weapon is **fissile material**. This term means a substance that “readily fissions after absorbing a neutron of any energy, fast or slow.”² It is this process that creates a nuclear detonation. Fissile materials are Uranium 235, Uranium 233, Plutonium 239, and Plutonium 241.³ Of all the organic essentials, this is the most difficult to come by.

Possessing the fissile material does not give a state a nuclear capability. Weapons must be assembled very precisely, and tolerances are very small. Because of this, **precision equipment** and **computer technology** are necessary to turn the fissile material into a nuclear device.

Precision is also required in the detonation system. For example, in an implosion device, a sphere of fissile material is surrounded by high explosive that has detonators placed throughout. All detonators must fire simultaneously in order to make the sphere implode correctly.⁴ Therefore, a **sophisticated timing and firing set** is required.

Knowledge is an organic essential for weapons development. The aspiring nuclear state must either have scientists and engineers who possess the knowledge to fabricate a weapon, or they must import the knowledge from a nuclear state.

Infrastructure

A state must possess the infrastructure required for producing a nuclear weapon. If it has access to uranium or plutonium, but not of the correct (fissile) isotopes, it will need an **enrichment facility** to transform the material to weapons grade. A **delivery system** is also required; this could include missiles, aircraft, artillery, or even less sophisticated means. Facilities involved in the project will require **electricity** to operate.

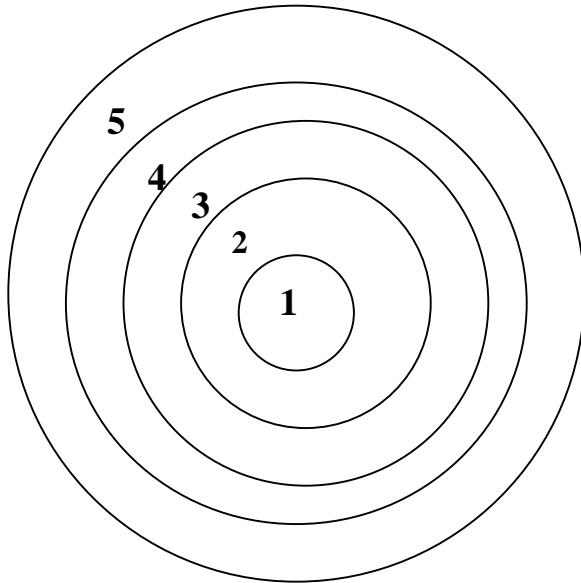
Population

There are two related populations that the JFC needs to consider. First are the scientists mentioned above. Without them, the program will not proceed. The second group is composed of highly skilled technicians who run the enrichment facility, operate the precision machinery, and weaponize the device. Both of these groups are critical to the program and take a long period to replace.

Fielded Forces

The key facilities for a nuclear program will be guarded by the best trained and equipped troops. This force will include more than ground units, but also air defense and surveillance systems. Together these are the primary fielded forces protecting the program.

A second fielded force is the state's counterintelligence/internal security apparatus. Any effort to compromise or destroy the program will be a primary target for the security organs of an aspiring nuclear state.



- 1. Leadership:** Head of state, program director, minister of defense
- 2. Organic Essentials:** fissile material, precision equipment/computer technology, timing and firing set, knowledge
- 3. Infrastructure:** Enrichment facility, delivery system, electricity
- 4. Population:** Scientists, technicians
- 5. Fielded Forces:** security force, CI/internal security apparatus

Figure 9 Five Ring Analysis Nuclear Weapon Production System

Key Centers of Gravity

In developing the operational level plan, the JFC's staff must determine the elements that are essential to the rogue state's ability to threaten US interests with a nuclear weapon.

There are two ways of affecting the leadership ring: assassination and persuasion. Assassination is unethical to many and against US policy, and therefore cannot be considered. Persuasion can take many forms, but these are outside of the JFC's responsibility.⁵

Several of the organic essentials are good COGs. Fissile material is extremely difficult to come by, but destroying it without creating an ecological disaster could be

difficult. One would also need to ensure that all stockpiles of fissile material have been identified and destroyed. Replacing precision equipment and computers would be expensive and time-consuming, but nonetheless they can be replaced. Eliminating “knowledge” means eliminating scientists, which as mentioned above, is against US policy. Also, one would have to ensure that all those in the state with the necessary knowledge were eliminated.

Enrichment facilities are an excellent COG. To destroy these is to eliminate the capability to convert harmless isotopes to fissile material, the very crux of the system. Unlike targeting the fissile material itself, the JFC’s J2 can be reasonably sure of the locations of all facilities engaged in enrichment (their expense results in little redundancy and they can be located through telltale indicators). Delivery systems, on the other hand, produce less payoff. First, as the US found in the effort to dismantle Iraqi SCUDs, missiles can be hidden safely away from US bombers. Aircraft are too numerous to eliminate. In fact, even if all delivery systems were destroyed, a device can be sent to the US aboard a merchant vessel or other surreptitious means. Electricity, another element of the infrastructure, is necessary to the enrichment and production process. However, even discounting back-up systems, electrical systems cannot be shut down indefinitely.

The population groups are not valid targets for the reasons enumerated above. Finally, eliminating the fielded forces does nothing to stop the production capability. Based on this analysis, the most effective method for the JFC to disrupt a nuclear weapons production program is to destroy the enrichment facility.

Nodal Analysis of the Enrichment Process

Enrichment is more precisely referred to as isotope separation. Isotopes are variations of an element that have different numbers of neutrons in the nucleus. For example, most natural uranium (Uranium 238, 99.3% of uranium ore) has 146 neutrons. Weapons grade uranium, Uranium 235, has 143 neutrons. The slight difference makes U-235 fissile, but not U-238.⁶ Enrichment is the process of taking uranium ore and separating out the 0.72% that is U-235 from the remainder of U-238 and other isotopes. Since the isotopes are similar physically and chemically, separation is much more difficult than purification among separate elements.⁷ This is what makes nuclear proliferation so difficult.

Besides U-235, Plutonium 239 can be used to manufacture weapons. However, doing so involves extra steps beyond those necessary to enrich uranium.⁸ Therefore, most proliferators seek U-235, and that process will be the example used in this chapter.

There are a variety of isotope separation methods. According to the Department of Energy's Office of Nonproliferation and National Security, five are most widely used for large-scale uranium enrichment. These are gaseous diffusion, gas centrifuge, laser isotope separation, chemical/ion exchange, and electromagnetic isotope separation.⁹ However, the Office states "at present, any country starting or upgrading a uranium enrichment program is most likely to choose the gas centrifuge process."¹⁰ This will be the system analyzed in this chapter.

Gas Centrifuge Process

This process operates on the principle that U-238, with more neutrons, is heavier than weapons-grade U-235. Therefore, centrifugal force will be stronger on U-238 than U-235 and allow them to be separated.¹¹

Uranium enters the centrifuge in a gaseous form, usually as the compound uranium hexafluoride (UF_6). The centrifuge itself is a cylinder with a rotor down the central axis. A vacuum is necessary inside the cylinder. UF_6 enters the cylinder, and the rotor spins the gas creating centrifugal force. The gas is forced along the inside wall of the cylinder, with the heavier U-238 isotopes moving closer to the wall (due to their heavier weight) than the U-235. Scoops in the centrifuge separately remove the two isotopes. The centrifugal force, and therefore the separative capacity, increases with the length of the rotor. Therefore, proliferants desire cylinders that are as tall as possible. Even with large cylinders, though, very little U-235 is separated because it is such a small percentage of the original uranium. According to the Department of Energy, “to be able to produce only one weapon per year, several thousand centrifuges would be required.”¹²

The main subsystems of the centrifuge are the cylinder assemblies (cylinder, rotor, scoops, valves, and endcaps), the structure supporting the cylinders and providing suspension, electric motor and power supply, and vacuum system.¹³ Each of these are critical. The cylinder components are manufactured to high tolerances and usually cannot be produced by a proliferant. The supporting structure and suspension reduces vibration, which otherwise results in the breakage of extremely high-speed (50,000 RPM) components. The electric system is “one of the more difficult components to produce or procure”¹⁴ because it must produce a “very pure single frequency.”¹⁵ The vacuum system

is also critical. A sudden, unexpected loss of vacuum in the cylinders can cause the entire system to break down.

Nodal Analysis of Weapon Production Using the Gas Centrifuge Process

Using this example, the process can be described using the nodal analysis shown in Figure 10. The first component is uranium ore, in this case in a gaseous form as uranium hexafluoride. It is processed in thousands of gas centrifuge cylinders, which rely on electrical supply, support and suspension, and a vacuum system. The product of the process is U-235 in sufficient quantities to produce a weapon (approximately 25 kg).¹⁶ That material then must be assembled with precisely manufactured weapon components to create a nuclear device. The device is then mated with a delivery system, such as a missile or aircraft. At this point, the proliferant state poses a threat.

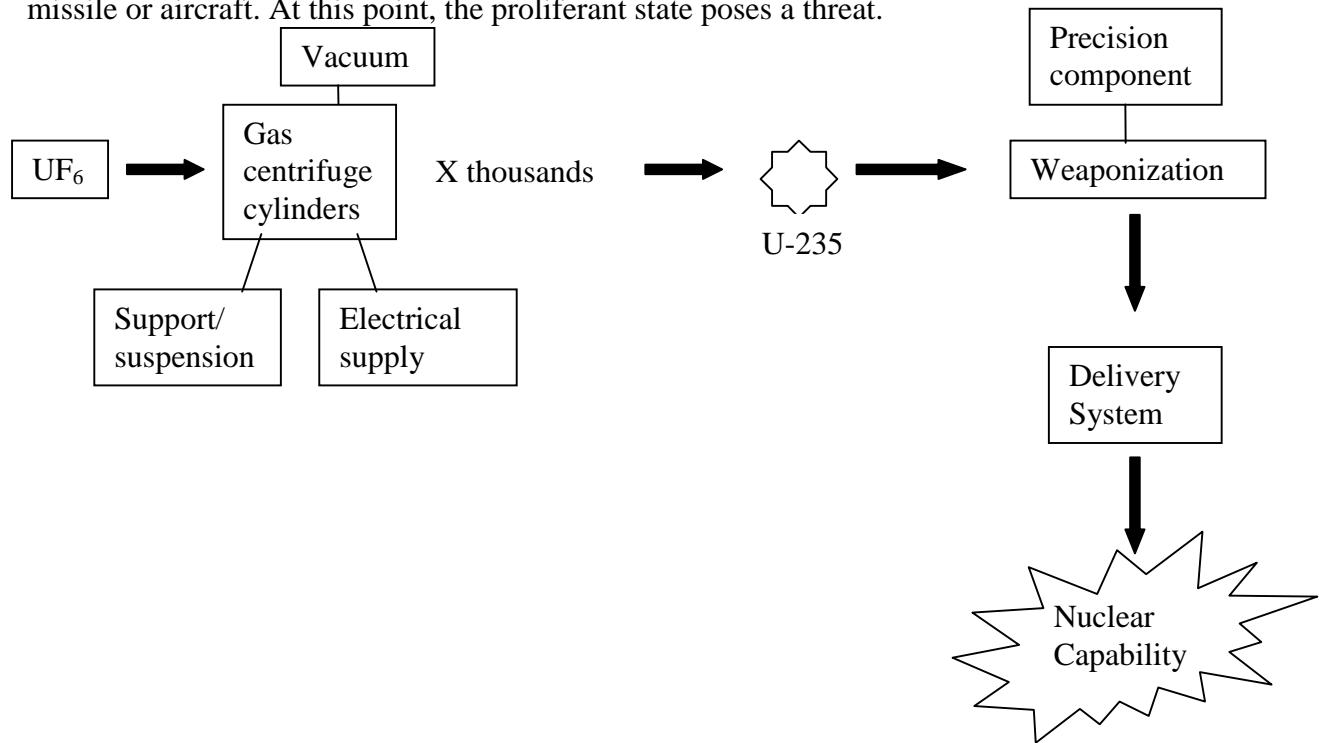


Figure 10 Nodal Analysis of Nuclear Weapons Program Using Gas Centrifuge Isotope Enrichment

The most vulnerable point in the system is the gas centrifuge process. The components, as stated earlier, are difficult to acquire or manufacture and are built to precise tolerances. Since the components are collocated at one complex, the JFC should endeavor to destroy the cylinders and their support structure, electrical power, and vacuum system. This can be accomplished through aircraft or missile strikes, and will present the proliferant with multiple components that must be replaced. A clear psychological signal would also be sent, that the US is aware of the program and has the will to use force to disrupt it.

Notes

¹ A National Security Strategy for a New Century (Unclassified) (Washington: The White House, May 1997), 6. The other two threats identified by the NSS are Regional or State-Centered Threats and Transnational threats.

² Nuclear Terms Handbook 1993 (Unclassified) (Washington: Dept of Energy, Office of Intelligence and National Security, 1993), 36.

³ Ibid.

⁴ Ibid. 98.

⁵ An example would be the US's decision to provide nuclear reactors to North Korea that could not be used for producing plutonium (so-called "breeder reactors") in exchange Pyongyang ending its nuclear weapons program.

⁶ Isotope Enrichment (Unclassified) (Oak Ridge, TN: Office of Nonproliferation and National Security, Department of Energy, Aug 1994), 10-13.

⁷ Ibid., 10.

⁸ Specifically, the proliferant would need to possess a special class of reactor, a 'production' reactor and reprocessing technologies. This would provide plutonium, which then must be enriched to separate the common Pu-240 isotope from weapons-grade Pu-239. The enrichment process is identical to U-235. Therefore, it's easier to start with uranium, skip the plutonium conversion process, and go straight to U-235 separation. See Isotope Enrichment, 12.

⁹ Isotope Enrichment, 38.

¹⁰ Ibid.

¹¹ Ibid., 56.

¹² Author's unclassified notes, Technical Responses to Nuclear Threat Course, Department of Energy, Las Vegas, NV, 9-12 Aug 1994.

¹³ Ibid.

¹⁴ Isotope Enrichment, 58.

¹⁵ Ibid.

Notes

¹⁶ Ibid., 20

Chapter Eight

Conclusions

As we prepare to enter the next century, the world's urban population is growing at an unprecedented rate. This trend will translate to more urban operations for the US military, at a time when reductions will make it impossible for a Joint Force Commander to occupy an entire city in order to achieve his objectives. He must concentrate his force where it will most efficiently achieve the desired end state.

The services are becoming aware of the need to re-examine urban warfare doctrine in the next century. However, the bulk of the work has been at the tactical level. The operational level of war has been ignored for urban operations.

The intent of this paper has been to focus the reader on the operational level of urban warfare. A key task for the Joint Force Commander and his staff will be to identify the targets against which he will employ his component forces. One method of doing this is by using John Warden's Five Ring Analysis as an aid in identifying key centers of gravity (COGs), then to perform a nodal analysis on those COGs in order to determine the specific components to be attacked.

Three typical operations were examined: noncombatant evacuation operations (NEOs), apprehension of individuals, and attacking nuclear weapons production capabilities. Why these three? First, they all have significant impact on national interests.

NEOs, which occur more often than any other urban operation, involve the protection of US civilians from death or injury. Apprehension missions, especially if the individual is a terrorist leader, directly target those who initiate attacks on US citizens or in other ways threaten national interests. Finally, nuclear proliferation presents the gravest danger to the US. The best way to defend against nuclear attack by a rogue state is to eliminate the production capability before the weapons exist.

The second reason for selecting these three mission types is variety. Each presents a different operational environment. NEOs require restraint and avoidance of combat and may take place in hostile, permissive, or semipermissive environments. Apprehension missions involve locating one individual in territory he is familiar with, and within which he enjoys informational superiority. Once he is located, the JFC's forces must surgically apply force in a manner which brings the individual into custody with minimum injury to anyone involved. Attacking nuclear facilities requires more firepower and less concern for collateral damage. These facilities are usually the most heavily defended targets in a country and involve the most risk to American forces.

In NEOs, the key nodes were determined to be the will of factional fighters who threaten US forces, as well as the road network between key evacuation locations. For apprehension missions, the analysis indicated that the JFC should eliminate the information superiority of the fugitive, and the best way to do that was to jam radio communications, eliminate landline central offices and cellular mobile telephone switching offices, and jam the link between satellite phones and ground stations. The third mission was disruption of a nuclear weapons program. In the example given,

destruction of the components of the isotope enrichment process was determined to be the key to success.

While these three missions are all key to US interests, they are only a few among the many missions one could envision in urban terrain. However, examining these three introduces the reader to the methods involved in target development at the operational level in the urban environment.

The individual nodes and sample missions are not the important product. The purpose of the paper is to show the process, and to move military planners from tactical level analysis of urban operations to the operational level.

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